

4712

Of the 13 species of maple (*Acer*) native to North America, only the sugar maple (*Acer saccharum* Marsh.) and the black maple (*Acer nigrum* Michx F.) are important in maple syrup production. These species are favored primarily because their sap is sweeter than that from other species. The region of maple syrup production extends from Maine west to Minnesota and from Quebec south to Indiana and West Virginia. It is likely that the Indians in the area of the Great Lakes and St. Lawrence River were the first to produce maple syrup and sugar, and the settlers recognized their value, as cane sugar was quite expensive. In early 18th century colonial America, with tea and coffee being consumed in great amounts, maple sugar was increasingly relied on as a sweetener.

U.S. production of maple syrup and sugar reached a maximum in the late 19th century and has been declining since, while Canadian production has remained relatively steady. The decline in U.S. production is attributed to increased supplies of cane and beet sugars, and the shortage of farm labor.

Advances over the last 25 years has made maple sap collection and its conversion to syrup a more efficient operation. The modern maple producer conducts his operations in a stand of sugar maple trees (sugar bush) that is spaced to maximize tree growth and ease of access for sap collection. Sap is normally collected during late winter and early spring, when sap flow is highest as a result of consecutive days with freezing temperatures at night and thawing temperatures during the day. The sap flow season normally ranges from 6 to 10 weeks. A maple tree should not be tapped if it is less than 10 in. in diameter at a distance of 4.5 ft from the ground, and an extra taphole can be added for each additional 5 in. of diameter. The taphole is drilled at waist level to a depth of 3 to 4 in. as the xylem at this depth is 30 to 45 years old and is most conducive to sap flow with optimum sugar concentrations.

A major advance in maple sap collection was made in 1962. After the taphole is bored, a germicidal pellet is inserted, which inhibits microbial growth during the sap flow season, thus preventing taphole clogging and insuring flow of sterile sap. It has been shown that when weather is favorable for microbial growth, pellets allow the doubling of sap yields. After placing the pellet into the taphole, a wood or metal spout is inserted, which serves to convey the sap to the collection vessel.

Traditionally, sap was collected by hanging 15-qt wooden or metal buckets on the sap spout. More recently, transparent plastic bags were developed, which have several advantages over the buckets, including small bulk and weight, making their storage and transport to the woods more convenient. Also, they are transparent to sunlight radiation, which helps keep the sap sterile. All these traditional forms of collection, however, have the disadvantage of being labor intensive.

In the past 10 years, the maple industry has been revolutionized by the introduction of plastic tubing networks to gather the sap. Plastic tubing is attached to the sap spout with a vertical line of tubing, which transfers the sap to a larger lateral line connecting a number of trees. This lateral line drains into collection tanks at the evaporation plant (sugar house). Replacing the sap buckets and plastic bags with tubing has eliminated much of the hard labor and has lowered syrup-making costs by as much as 40%. The germicidal pellets insure that the pipeline is kept clean and sterile during the transportation of the sap.

A typical taphole will yield from 5 to 15 gal of sap each season. Sap is essentially a 2% aqueous solution of sucrose, and syrup is produced by boiling water from the sap

until the solids content has increased to 67%, so each taphole, on the average, can yield 0.5 to 1.5 qt of maple syrup.

Maple syrup production is carried out by atmospheric boiling of maple sap in an open-pan evaporator; during this process, the characteristic flavor and color of maple syrup are developed. Conditions have been established to optimize the production of light-colored syrups, as these bring the highest prices on the retail market. Maple sugar is produced by continuing the evaporation of syrup until the temperature of 230°F is reached, after which the sugar will crystallize on cooling.

In 1977, the U.S. produced over 1.2 million gal of maple syrup, with a value of \$14.6 million. Canada produces more than twice this amount, mainly in Quebec, and the U.S. imported almost 0.9 million gal of maple syrup from Canada in 1977. The states of Vermont and New York are the leaders in American maple syrup production, accounting for over 60% of the total in 1977. Only a small percentage of tappable sugar maples are utilized in the U.S.

Pure maple syrup is consumed more frequently by residents of the producing states, where it is available from roadside stands and sugar houses. Most often it is used over pancakes, waffles, french toast, and ice cream. Less often it is added to breakfast cereals and beverages.

Maple sap as it comes from the tree contains about 2% solids, of which 97% is sucrose. The remainder of the solids includes organic acids (1.5%), ash (0.7%), nitrogenous material (0.4%), and trace amounts of lignin and related compounds. A number of compounds present in maple syrup result from chemical changes that occur during evaporation of the sap. Some are derived from sucrose, and others from the lignin fraction of sap. The lignin-derived fraction includes vanillin, coumarin, and syringaldehyde, and these contribute to the characteristic maple flavor.

See Tables 1 to 31 and Figure 1.

Table 1
PRODUCTION AND VALUE OF MAPLE SUGAR AND SYRUP, U.S.
(SELECTED YEARS, 1925—1960)¹

Year	Trees tapped (1000 trees)	Sugar		Syrup		Total product in terms of syrup ^a (1000 gal)	Value of total product (\$1000)
		Produc- tion (1000 lb)	Price per lb (\$)	Produc- tion (1000 gal)	Price per gal (\$)		
1925	14,070	3,238	0.282	2,817	1.99	3,220	6,504
1930	13,158	2,134	0.301	3,712	2.03	3,979	8,172
1935	12,341	1,241	0.267	3,432	1.42	3,586	5,213
1940	9,970	394	0.298	2,601	1.65	2,651	4,413
1945	7,685	202	0.546	1,030	3.21	1,053	3,414
1950	8,090	246	0.722	2,006	4.12	2,035	8,469
1955	6,138	—	—	1,578	4.68	1,578	7,383
1960	—	—	—	1,124	4.96	1,124	5,567

Assuming 1 gal syrup is equivalent to 8 lb of sugar.

Table 2
MAPLE SYRUP AND SUGAR: PRODUCTION, FARM DISPOSITION,
SEASON AVERAGE PRICE RECEIVED BY FARMERS, AND VALUE, U.S.,
(1963—1977)²

Year	Production		Disposition of farms where produced		Season average price per gal of syrup (\$)	Value of production (\$1000)
	Syrup ^a	In terms of sugar ^a	Home use	Sold		
	(1000 gal)	(1000 lb)	(1000 gal)	(1000 gal)		
1963	1,143	9,144	68	1,077	4.86	5,559
1964	1,546	12,368	91	1,455	5.02	7,765
1965	1,266	10,128	84	1,182	5.04	6,389
1966	1,476	11,808	84	1,392	4.96	7,319
1967	979	7,832	65	914	5.33	5,215
1968	983	7,864	62	921	5.48	5,391
1969	1,032	8,256	64	968	6.15	6,350
1970	1,110	8,880	71	1,039	6.83	7,575
1971	962	7,696	60	902	7.10	6,825
1972	1,099	8,792	57	1,042	8.79	9,670
1973	857	6,856	47	810	9.35	8,018
1974	1,087	8,696	70	1,017	9.91	10,768
1975	1,201	9,608	91	1,110	10.60	12,728
1976	927	7,416	84	843	11.48	10,638
1977	1,221	9,768	73	1,148	12.00	14,661

^a Includes syrup later made into sugar.

^b Assuming that 1 gal of syrup is equivalent to 8 lb of sugar.

Table 3
U.S. MAPLE PRODUCTION, IMPORTS, AND TOTAL AMOUNT
AVAILABLE FOR U.S. CONSUMPTION (SELECTED YEARS,
1925—1963)¹

Year	U.S. production in terms of syrup (1000 gal)	Imports		Total in terms of syrup* (1000 gal)	Total product available for consumption in terms of syrup (1000 gal)
		Sugar (1000 lb)	Syrup (1000 lb)		
1925	3,220	3,911	113	499	3,719
1930	3,979	9,735	1,575	1,360	5,339
1935	3,586	1,920	2,469	464	4,050
1940	2,651	4,087	4,660	935	3,586
1945	1,053	4,131	1,232	628	1,681
1950	2,035	6,549	5,282	1,299	3,334
1955	1,578	6,024	5,044	1,212	2,790
1960	1,124	5,742	10,009	1,628	2,752
1963	1,115	4,960	11,778	1,691	2,806

* Assuming that 11 lb of syrup or 8 lb of sugar are equivalent to 1 gal of syrup.

Table 4
MAPLE SUGAR AND SYRUP: TREES TAPPED, PRODUCTION, AVERAGE PRICE RECEIVED BY FARMERS,
AND IMPORTS, U.S. (SELECTED YEARS, 1918—1970)*

Year	Production				Price		Imports for consumption
	Trees tapped (1000 trees)	Sugar made (1000 lb)	Syrup made (1000 gal)	Total product in terms of sugar* (1000 lb)	Average total product per tree		
					As sugar* (lb)		
					As syrup* (gal)		
					Per lb of sugar (£)	Per gal of syrup (\$)	
1918	17,052	11,383	4,141	44,511	2.61	0.33	3,807
1925	14,070	3,238	2,817	25,774	1.83	.23	3,911
1930	13,158	2,134	3,712	31,830	2.42	.30	9,735
1935	12,341	1,241	3,432	28,697	2.33	.29	1,920
1940	9,970	394	2,601	21,202	2.13	.27	4,087
1945	7,685	202	1,030	8,442	1.10	.14	4,131
1950	8,090	246	2,006	16,302	2.02	.25	6,549
1955	6,138		1,578	12,624		.26	6,024
1960			1,124	8,992			5,742
1965			1,266	10,128			4,688
1970			1,110	8,880			3,561
							10,549

* Assuming that 1 gal of syrup is equivalent to 8 lb of sugar.

* Obtained by weighting state prices by quantity sold from 1945 to date; prior to 1945 weighted by production.

* A gal of syrup weighs about 11 lb.

Table 5
MAPLE SYRUP: PRODUCTION,
IMPORTS, AND INDICATED
DOMESTIC CONSUMPTION, U.S.
(1963—1977)²

Year	Production (1000 gal)	Imports (1000 gal)	Indicated domestic consumption (1000 gal)
1963	1143	1068	2211
1964	1546	666	2212
1965	1266	879	2145
1966	1476	938	2414
1967	979	1147	2126
1968	983	988	1971
1969	1032	1185	2217
1970	1110	956	2066
1971	962	577	1539
1972	1099	710	1809
1973	857	803	1660
1974	1087	801	1888
1975	1207	607	1814
1976	927	886	1813
1977	1221	867	2088

Table 6
MAPLE SYRUP: PRODUCTION, PRICE AND VALUE, BY STATES
(1975—1977)^{2,4}

	Production (1000 gal)			Price (\$/gal)			Value (\$1000)		
	1975	1976	1977	1975	1976	1977	1975	1976	1977
Maine	9	7	8	13.70	13.50	15.50	123	95	109
Massachusetts	31	27	27	10.70	11.50	14.20	332	311	369
Michigan	98	69	90	12.00	12.70	13.40	1,176	876	1,152
New Hampshire	71	57	74	12.80	13.00	14.60	909	741	993
New York	366	277	320	9.80	9.60	11.10	3,587	2,659	3,330
Ohio	114	50	88	11.30	11.50	12.00	1,288	575	972
Pennsylvania	97	40	47	10.80	11.10	12.00	1,048	444	928
Vermont	353	334	437	10.50	11.00	12.20	3,707	3,674	5,014
Wisconsin	62	66	130	9.00	9.80	10.50	558	647	1,313
U.S.	1,201	927	1,221	10.60	10.81	12.00	12,728	10,022	13,780

Table 7
MAPLE SYRUP: PRODUCTION, FARM DISPOSITION, AND VALUE, BY
STATES (CROP OF 1977)²

State	Production (1000 gal)	Disposition on farms where grown		Season average price/ gal (\$)	Value of	
		Home use (1000 gal)	Sold (1000 gal)		Production (\$1000)	Sales (\$1000)
Maine	8	1	7	15.50	124	109
Massachusetts	27	1	26	14.20	383	369
Michigan	90	4	86	13.40	1,206	1,152
New Hampshire	74	6	68	14.60	1,080	993
New York	320	20	300	11.10	3,552	3,330
Ohio	88	7	81	12.00	1,056	972
Pennsylvania	47	3	44	12.00	564	528
Vermont	437	26	411	12.20	5,331	5,014
Wisconsin	130	5	125	10.50	1,365	1,313
Total	1,221	73	1,148	12.00	14,661	13,780

Table 8
RANK OF STATES IN PRODUCTION OF MAPLE SYRUP (SELECTED YEARS
1926—1971)³

Rank	1926	1931	1936	1941	1946	1951	1956	1961	1966	1971
1	N.Y.	Vt.	Vt.	Vt.	Vt.	Vt.	Vt.	Vt.	NY	NY
2	Vt.	NY	NY	NY	NY	NY	NY	NY	Vt.	Vt.
3	Ohio	Ohio	Ohio	Ohio	Ohio	Pa.	Ohio	Ohio	Wis.	Ohio
4	Pa.	Pa.	Pa.	Pa.	Mich.	Mich.	Pa.	Wis.	Pa.	Pa.
5	Mich.	Mich.	Mich.	Mich.	Pa.	Mass.	Wis.	Mich.	Mich.	Mich.
6	N.H.	Wis.	Wis.	Mass.	NH	NH	Mich.	Pa.	Ohio	Wis.
7	Mass.	NH	NH	NH	Mass.	Wis.	NH	NH	NH	NH
8	Wis.	Mass.	Mass.	Wis.	Wis.	Maine	Mass.	Mass.	Mass.	Mass.
9	Maine	Md.	Md.	Maine	Maine	Md.	Md.	Md.	Md.	Maine
10	Md.	Maine	Maine	Md.	Md.	Ohio	Maine	Maine	Minn	—
11	—	—	—	—	—	Minn.	Minn.	Minn.	Maine	—

Table 9
PRODUCTION AND VALUE OF MAPLE SUGAR AND SYRUP,
CANADA (SELECTED YEARS, 1925—1963)¹

Year	Sugar		Syrup		Total product in terms of syrup (1000 gal) ^a	Value of total product (\$1000) ^a
	Production (1000 lb) ^a	Price /lb (\$) ^a	Production (1000 gal)	Price/gal (\$) ^a		
1925	10,496	0.180	2,008	1.71	3,320	5,286
1930	8,208	0.170	2,625	1.47	3,651	5,242
1935	6,539	0.109	2,703	1.02	3,520	3,505
1940	3,438	0.131	3,309	0.95	3,739	3,584
1945	1,920	0.243	1,607	2.24	1,847	4,070
1950	1,824	0.342	3,364	2.71	3,592	9,729
1955	847	0.528	2,577	4.12	2,683	11,034
1960	390	0.526	3,022	3.43	3,071	10,589
1963	720	0.510	3,265	3.13	3,355	10,567

- ^a Production, prices and values are expressed according to U.S. standards. Computation made assuming 1.20094 U.S. gal equals 1 Canadian gal and 8 lb of sugar is equal to 1 U.S. gal of syrup. Prices and values were further converted according to exchange rates published in the Federal Reserve Bulletin.

Table 10
CANADIAN MAPLE SYRUP
PRODUCTION BY PROVINCE
(1961—1964)¹

Province	Syrup made ^a (1000 gal)			
	1961	1962	1963	1964
Quebec	3000	3126	3072	1932
Ontario	387	376	264	187
New Brunswick	22	12	14	7
Nova Scotia	7	5	5	1
Total	3416	3519	3355	2127

^a Expressed in U.S. gal (1.20094 U.S. gal equals 1 Canadian gal). Assumes 8 lb of sugar is equal to 1 U.S. gal of syrup.

Table 11
PRODUCTION OF MAPLE
SYRUP IN THE U.S. AND
CANADA^{2,5}

Year	U.S. (1000 gal)	Canada (1000 gal)
1870	4477	2160
1880	6368	2570
1890	6377	3136
1900	3548	2226
1909	5859	3476
1919	4719	3014
1929	2509	2385
1939	2501	2616
1949	1480	2608
1959	1049	3092
1971	962	1676
1972	1099	2470
1973	857	2988
1974	1087	2182

Table 12
PRODUCTION AND VALUE OF MAPLE SUGAR AND SYRUP,
NORTH AMERICA (U.S. AND CANADA COMBINED)
(SELECTED YEARS, 1925—1963)*

Year	Sugar		Syrup		Total product in terms of syrup (1000 gal)*	Value of total product (\$1000)*
	Production (1000 lb)*	Price/lb (\$)*	Production (1000 gal)	Price/gal (\$)*		
1925	13,734	0.204	4,825	1.87	6,540	11,790
1930	10,342	0.197	6,337	1.80	7,630	13,414
1935	7,780	0.134	6,135	1.24	7,106	8,718
1940	3,832	0.148	5,910	1.26	6,390	7,997
1945	2,122	0.272	2,637	2.62	2,900	7,484
1950	2070	0.393	5,370	3.24	5,627	18,198
1955	847	0.528	4,155	4.33	4,261	18,417
1960	390	0.526	4,146	3.87	4,195	16,156
1963	720	0.510	4,380	3.57	4,470	15,976

* Production, prices and values are expressed according to U.S. standards. Computation made assuming 1.20094 U.S. gal equals 1 Canadian gal and 8 lb of sugar is equal to 1 U.S. gal of syrup. Prices and values were further converted according to exchange rates published in the Federal Reserve Bulletin.

Table 13
ADDITIONAL TAPS THAT COULD BE MADE BY
MAPLE PRODUCERS ON THEIR OWN FARMS AS A
PERCENTAGE OF TOTAL TAPS (BY SIZE OF
OPERATION, 1488 PRODUCERS, 14 STATES, 1963)¹

Size of operation in total gal produced	Number of producers reporting	Taps presently made	Additional taps available	Additional as % of present
0—199	721	433,444	293,865	68
200—399	459	615,907	265,428	43
400—599	169	340,724	115,525	34
600—799	66	183,815	63,750	35
800 and over	74	346,230	124,260	36
Total or average	1,489	1,920,120	862,828	45

Table 14
NUMBER OF TAP HOLES AND PERCENTAGE OF
CHANGE BY SIZE OF OPERATION (1450
PRODUCERS IN 14 STATES FROM 1958—1963)¹

Size of operation in total gallons produced	Number of producers reporting	Trend category (% of producers reporting)		
		Increased	Decreased	Remained the same
0—199	701	24	14	62
200—399	447	35	9	56
400—599	165	44	5	51
600—799	65	58	2	40
800 and over	72	63	2	35
Total or average	1450	33	10	57

Table 15
AVERAGE GROSS RECEIPTS AND
PERCENTAGE OF TOTAL FARM RECEIPTS
RETURNED BY THE MAPLE ENTERPRISE TO
PRODUCERS (BY SIZE OF OPERATION, 1149
PRODUCERS, 14 STATES, 1962)¹

Size of operation in total gal produced	Number of producers reporting	Average gross receipts from maple (\$)	Per cent of total farm gross receipts
0—199	545	554	22
200—399	357	1325	22
400—599	127	2205	24
600—799	53	2813	29
800 and over	59	5964	35
Total or average	1141	1364	23

Table 16
COMPARISON OF THE CHANGE IN NUMBER OF MAPLE
PRODUCERS AND NUMBER OF TOTAL FARMS IN COMMERCIAL
MAPLE PRODUCING COUNTIES (10 STATES, 1950 AND 1959)¹

State	Maple counties*	Maple producers			Total farms		
		1950	1959	% change	1950	1959	% change
Maine	8	1,488	269	-82	16,926	9,605	-43
Massachusetts	5	725	223	-69	11,161	5,886	-47
Maryland	2	106	59	-44	2,743	1,882	-31
Michigan	52	2,865	959	-67	104,599	76,980	-26
New Hampshire	10	1,688	441	-74	13,391	6,542	-51
New York	45	7,018	2,657	-62	107,327	71,537	-33
Ohio	43	1,987	914	-54	101,350	71,270	-30
Pennsylvania	19	2,445	1,004	-59	41,557	28,513	-31
Vermont	14	5,025	2,001	-60	19,043	12,099	-36
Wisconsin	37	2,607	1,227	-53	97,303	76,177	-22
Total or average	235	25,954	9,754	-62	515,400	360,491	-30

* A commercial maple producing county is here defined as one having a tap hole density of one or more per square mile based on the 1959 U.S. Census of Agriculture.

Table 17
AVERAGE NUMBER AND TYPE OF TAPS
MADE, BY SIZE OF OPERATION (1489
PRODUCERS, 14 STATES, 1963)¹

Size of operation in total gallons produced	Average taps made	Types of taps (% of taps made)		
		Buckets	Plastic bags	Plastic tubing
0—199	601	88	3	9
200—399	1342	91	2	7
400—599	2016	83	7	10
600—799	2785	88	1	11
800 and over	4679	87	4	9
Average	936	88	3	9

Table 18
TAPPABLE MAPLE TREES, AND
TREES TAPPED (EASTERN
STATES, 1951)¹

State	Tappable trees*	Trees tapped	
		Number	%
Maine	53,553	136,000	0.25
Maryland	1,660	28,000	1.7
Massachusetts	11,913	166,000	1.4
New Hampshire	12,103	261,000	2.2
New York	73,128	1,960,000	2.7
Pennsylvania	33,553	422,000	1.3
Vermont	25,840	3,118,000	12.1
West Virginia	13,031	—	—

* Larger than 10 in. in diameter at breast height.

Table 19
GRADE DESIGNATIONS OF MAPLE
SYRUP, AS DETERMINED BY COLOR¹

Grade designation	Color	Color index range
U.S. Grade AA (New York fancy or Vermont fancy)	As light as or lighter than light amber	0—0.510
U.S. Grade A (New York No. 1 or Vermont A)	Darker than light amber but as light as or lighter than medium amber	0.510—0.897
U.S. Grade B (New York No. 2 or Vermont B)	Darker than medium amber but as light as or lighter than dark amber	0.897—1.455
Unclassified (New York No. 3 or Vermont C)	Darker than dark amber	Over 1.45

Table 20
GRADE OF MAPLE SYRUP PRODUCED, BY
SIZE OF OPERATION, 1493 PRODUCERS, 14
STATES (1963)¹

Size of operation in total gallons produced	Total production reported (gal)	Grade (% of production reported)			
		Fancy	A	B	C
0—199	77,386	39	38	17	6
200—399	126,771	46	33	15	6
400—599	80,472	47	30	16	7
600—799	44,409	47	29	15	9
800 and over	90,609	46	29	17	8
Total or average	419,647	45	32	16	7

Table 21
FOODS USED WITH PURE
MAPLE SYRUP^a

Food	Maple area (%)	Other area (%)
Pancakes	95.2	92.7
Waffles	56.9	63.9
French toast	57.3	42.4
Ice cream	28.9	12.4
Cereal	5.7	3.0
Drinks	2.6	1.5
Others	22.8	26.0
Basis: total number of respondents	959	469

Table 22
FREQUENCY OF PURE MAPLE SYRUP USE BY SEASON
(% of respondents)^a

Frequency of use	Summer		Fall		Winter		Spring	
	M.A. ^a	O.A. ^b	M.A.	O.A.	M.A.	O.A.	M.A.	O.A.
More than once a week	15.5	8.9	16.9	15.0	19.2	18.9	18.7	9.6
Once a week	15.5	11.7	18.1	16.3	20.6	23.8	18.2	12.0
Three times per month	8.3	4.3	10.0	7.5	11.0	10.1	9.4	5.3
Twice per month	13.8	8.5	15.5	12.6	16.3	15.2	15.1	9.0
Once per month	12.2	9.8	12.5	12.4	14.4	16.4	12.4	9.4
Not used	34.9	56.6	27.0	36.2	18.6	15.7	26.2	54.7
Basis: total number of respondents	944	469	941	467	939	466	942	468

^a M.A. = Maple area

^b O.A. = Other area

Table 23
SOURCES OF RETAIL
PURCHASES OF PURE
MAPLE SYRUP^a

Source	Maple area (%)	Other area (%)
Retail store, super- market	24.5	67.9
Specialty shop, delica- tessen	3.9	10.4
Roadside stand, sugar house, or farmer's house	60.2	9.3
Gift shop	5.9	3.8
Mail order company	0.3	2.2
Other	5.2	6.3
Basis: total number of respondents	674	365

Table 24
PRIMARY OCCUPATION OF PRODUCERS BY SIZE
OF OPERATION (1445 PRODUCERS, 14 STATES,
1963)*

Size of operation in total gallons produced	Number of producers reporting	Occupational class		
		Fulltime farmer (%)	Part-time farmer (%)	Non-farmer (%)
0—199	698	79	6	15
200—399	448	82	8	10
400—599	164	85	4	11
600—799	63	76	13	11
800 and over	72	80	11	10
Total or average	1445	80	7	13

Table 25
COMPOSITION OF MAPLE SYRUP

Component	Amount (%)	Component	Amount (%)
Water	34.0	Soluble ash	0.30—0.81
Sucrose	58.2—65.5	Insoluble ash	0.08—0.67
Hexoses	0.0—7.9	Calcium	0.07
Malic acid	0.093	Silica	0.02
Citric acid	0.010	Manganese	0.005
Succinic acid	0.008	Sodium	0.003
Fumaric acid	0.004		

From White, J. W., Jr. and Underwood, J. C., *Symposium Sweeteners*, Inglett, G. E., Ed., AVI Publishing, Westport, Conn., 1974, 111. With permission.

Table 26
COMPOSITION OF MAPLE SAP AND
SYRUP^a

Component	Sap (%)	Sap (dry weight) (%)	Syrup (dry weight) (%)
Sugars	2.000	97.0	98.0
Organic acids	0.030	1.5	0.3
Ash	0.014	0.7	0.8
Protein	0.008	0.4	0.4
Unaccounted for	0.009	0.4	0.5

Table 27
TRACE ORGANIC CONSTITUENTS OF
MAPLE SYRUP

Ether	Ethoxymethylfurfural
Ethyl acetate	Diethyl malate
Ethyl alcohol	Ethoxydiethyl succinate
Chloroform	Ethyl palmitate
Diethyl carbonate	Para ethoxy phenol
Ethyl valerate	Ethyl phthalate
Ethyl caproate	Hydroxymethylfurfural
Acetol	Ethyl stearate
Ethyl lactate	Ethyl oleate
Ethyl heptate	Vanillin
Phenetole	Acetovanillone
Ethyl octanoate	Guaiacyl acetone
Diethyl oxalate	Ethyl vanillate
Furfural	Chloropropyl guaiacol
1,1,2,2-tetrachloroethane	Vanilloyl acetyl
Ethyl nonanoate	Syringaldehyde
Ethyl levulinate	Dihydroconiferyl alcohol
Diethyl fumarate	Butylphthalylbutylglycollate
Methylcyclopentenolone	

From Filipic, V. J., Underwood, J. C., and Dooley, C. J., *J. Food Sci.*, 34(2), 105, 1969. With permission.

Table 28
NONVOLATILE ORGANIC ACIDS IN
MAPLE SAP AND SYRUP^a

Acid	Sap (%)	Sap (dry weight) (%)	Syrup (dry weight) (%)
Malic	0.021	1.40	0.141
Citric	0.002	0.13	0.015
Succinic	0.0003	0.02	0.012
Fumaric	0.0003	0.02	0.006
Glycolic or dihydroxybutyric	0.000	0.00	0.006
Unidentified acids			
I, II, III, IV	Trace	Trace	Trace
V, VI, VII	0	0	Trace

Table 29
MINERAL COMPOSITION
OF MAPLE SYRUP^a

Component	Syrup (%)	Dry weight (%)
Soluble ash	0.38	0.58
Insoluble ash	0.28	0.42
Total ash	0.66	1.00
Potassium	0.26	0.40
Calcium	0.07	0.11
Silicon oxide	0.02	0.03
Manganese	0.005	0.008
Sodium	0.003	0.005
Magnesium	Trace	Trace

Table 30
SUGARS IN MAPLE SAP AND SYRUP^a

Sugars	Sap (%)	Sap (dry weight) (%)	Syrup (dry weight) (%)
Hexoses	0	0	0—12
Sucrose	1.44	96.00	88—99
Raffinose and a glycosyl sucrose	0.00021	0.014	—
Oligosaccharides			
I	0.00018	0.013	—
II	0.00020	0.014	—
III	0.00042	0.028	—

Table 31
**THE TARIFF ON MAPLE
SYRUP AND SUGAR IMPORTS
FROM CANADA^a**

Maple syrup		Maple sugar	
Year	¢/lb	Year	¢/lb
1925—1943	4.0	1925—1930	4.0
1944—1947	2.0	1931—1935	6.0
1948—1967	1.5	1936—1944	4.0
1968	1.2	1945—1947	3.0
1969	0.9	1948—1967	2.0
1970	0.6	1968	1.6
1971	0.3	1969	1.2
		1970	0.8
		1971	0.4

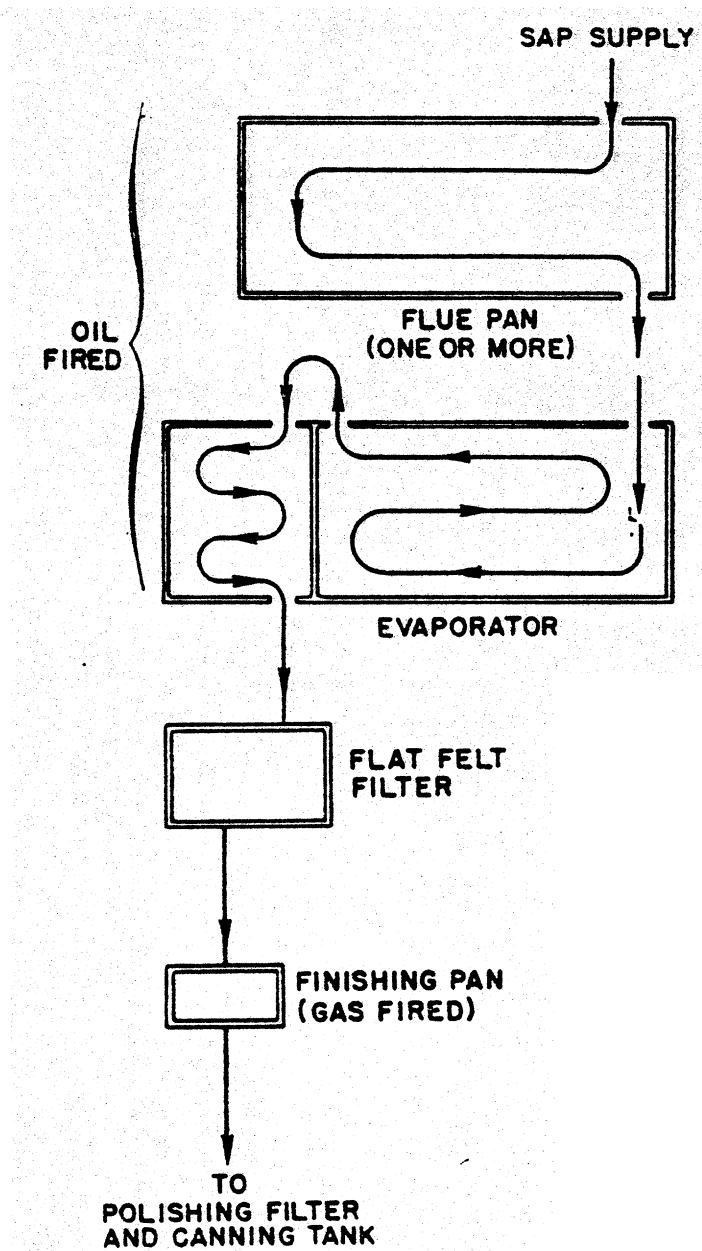


FIGURE 1. Flow diagram of a multiple unit maple sap evaporator.